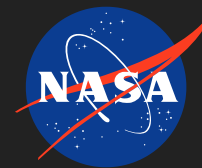


## Protein Colloidal Aggregation

Completed Technology Project (2012 - 2014)



## Project Introduction

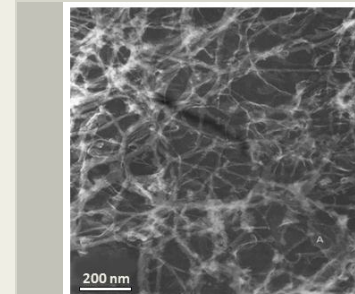
Finding an optimal treatment for any disease is impossible until we fully understand its cause. We believe the central problem in obtaining this understanding is that the most commonly proposed models for amyloid aggregation may be incorrect, and that the process is not fundamentally biological. We plan to investigate the pathways and kinetics of protein aggregation to allow accurate predictive modeling of the process and evaluation of potential inhibitors to prevalent diseases including cataract formation, chronic traumatic encephalopathy, Alzheimer's Disease, Parkinson's Disease and others.

The goal of the Protein Colloidal Aggregation project is to understand the underlying cause of several major diseases, including Alzheimer's, Parkinson's, and chronic traumatic encephalopathy. These diseases all occur when protein molecules undergo a peculiar and irreversible process in which they aggregate to form tiny fibers of a unique material called amyloid, which the body cannot remove. Despite enormous investment in research, the fundamental physiochemical mechanism of these diseases remains poorly understood. Based on initial studies using atomic force microscopy (AFM), we theorized that the aggregation of proteins in these diseases is driven instead by colloidal interactions, the same forces that govern the behavior of nanoscale particles in the colloidal suspensions we encounter every day, such as paint, milk, and clouds. Our theory is being validated by the evidence. For many years, NASA has been heavily involved in research into the structure of proteins and their assembly into crystals, and in studying the colloidal interactions and aggregation of nanoscale particles. To date, however, NASA's colloid research has involved only nonbiological materials. But now we are bridging these two fields by studying the colloidal aggregation of proteins.

## Anticipated Benefits

The research can only go so far on Earth because gravity keeps the protein structures from growing beyond a certain size in the laboratory before they collapse of their own weight. Scientists want to send a container holding the proteins to the International Space Station to find out if protein strands grow as the researchers expect. If their theory holds, the proteins should clump together in larger structures than are seen in Earth's normal gravity.

The project is scheduled to fly on Nanoracks in September 2014.



Protein Colloidal Aggregation

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## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Center / Facility:**

Kennedy Space Center (KSC)

**Responsible Program:**

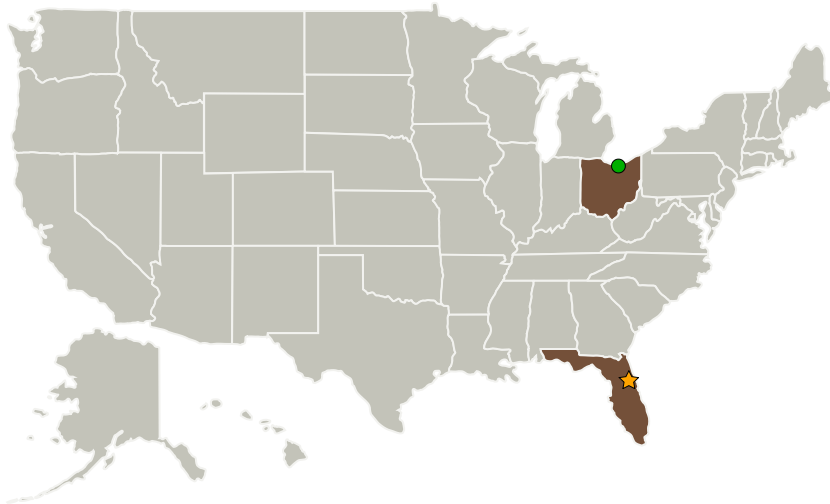
Center Innovation Fund: KSC CIF

## Protein Colloidal Aggregation

Completed Technology Project (2012 - 2014)



## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Kennedy Space Center(KSC)	Lead Organization	NASA Center	Kennedy Space Center, Florida
Florida Institute of Technology	Supporting Organization	Academia	Melbourne, Florida
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio
QinetiQ North America(QNA)	Supporting Organization	Industry	

## Primary U.S. Work Locations

Florida	Ohio
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## Project Management

**Program Director:**

Michael R Lapointe

**Program Manager:**

Barbara L Brown

**Project Manager:**

David A Tipton

**Principal Investigator:**

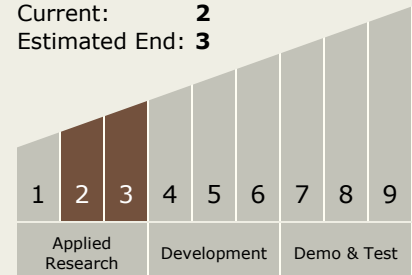
David A Tipton

**Co-Investigator:**

Daniel Woodard

## Technology Maturity (TRL)

Start: 2  
Current: 2  
Estimated End: 3



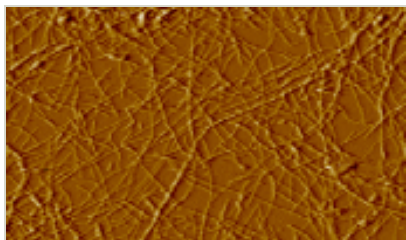
## Technology Areas

**Primary:**

- TX04 Robotic Systems
  - TX04.4 Human-Robot Interaction
    - TX04.4.3 Remote Interaction

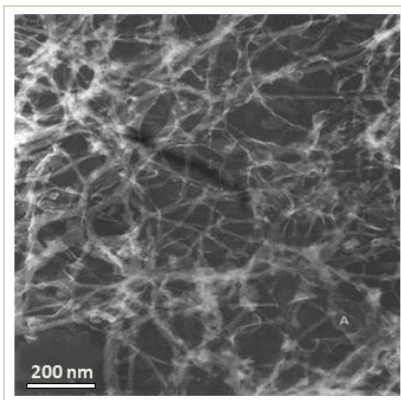


## Images



### AFM Image

Atomic Force Microscopy of  
Lysozyme Fibers Forming a  
Molecular Network  
(<https://techport.nasa.gov/image/2656>)



### SEM Image

Scanning Electron Micrograph of  
Amyloid Gel  
(<https://techport.nasa.gov/image/2655>)

### Protein Colloidal Aggregation

Protein Colloidal Aggregation  
(<https://techport.nasa.gov/image/2125>)